ADDIS ABABA SCIENCE & TECHNOLOGY UNIVERSITY

SCHOOL OF GRADUATE STUDIES

COMPARISON BETWEEN DESIGN BID BUILD AND DESIGN BUILD DELIVERY SYSTEM IN FEDERAL ROAD PROJECTS

BY

BY HABTAMU GEBREYOHANNES

JUNE 2017

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AN INDEPENDENT PROJECT SUBMITTED TO THE SCHOOL OF GRADUATE STUDIES OF ADDIS ABABA SCIENCE AND TECHNOLOGY UNIVERSITY IN PARTIAL FULFILLMENT OF THE REQUIREMENT OF DEGREE OF MASTER OF ENGINEERING IN CIVIL ENGINEERING

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BY HABTAMU GEBREYOHANNES

JUNE 2017

DECLARATION

I, the undersigned, declare that this independent project is my original work performed and it has not been presented as an independent project for a degree in any other university. All sources of material used for this independent project have also been duly acknowledged

Name: Habtamu Gebreyohannes

Signature: ……..

Place: Addis Ababa Science and Technology University

Date: June 2017

Name of Proffesor :- Habtamu Zelelew(Dr.)

Prep. By :- **Habtamu G/yohannes**

I.D No. :- **GSR/0147/06**

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SYMBOLS AND ABBREVATIONS

RSDP-Road Sector Development Program me

DBB- Design Bid Build

DB-Design Build

ERA-Ethiopian Road authority

BOT-Build Operate Transfer

FIDIC-Federation International Des Ingeniers Conseils (international Federation of Consulting Engineers)

MEP-Mechanical Electrical and Plumbing

ETB-Ethiopian Birr

CCCC- China Communications Construction Company

VAT- Value Added tax

ABSTRACT

Road connectivity is one of the key components for development, as it promotes access to economic and social services, generating increased income and employment. However, the construction of such economically vital sector is the most expensive of public works project undertaken by the society. By taking in to consideration relationship between infrastructure development and economical development of the country Ethiopia has been engaged in road construction development in an organized manner since 1951 when the government of Emperor Hailesellasie regime established the imperial Highway Authority. With the help of World Bank funds and with technical assistance from the United States Bureau of public Roads, the development of Ethiopia's highway system continued.

Hence modern and effective road sector construction demands proper contract delivery system. These systems have been developed with time in order to narrow the gap that has been observed in design bid build. It have been observed with different previous research that project could not meet their budgeted time and cost in traditional delivery system (DBB)

.

In this research paper it has been tried to compare design bid build and design build delivery system in federal road projects. By interviewing key personnel from client (Ethiopian road authority), contractors and consultants in the mean time two projects have been taken as a case study one with design bid build the other with design build. In the case study Nekemte-Mekenajo is taken as DBB on the other hand Alamata-Mehoni-Hewane is taken as DB project. Factors to consider project delivery system are complexity of project, Project size (cost estimate), demanding of early contractor involvement desired or not, is price or qualifications the driving factor in selection or not, Single point responsibility over multiple contracts and Project schedule requirements.

It is concluded that generally projects that are using design bid build are subjected for cost overrun, time overrun, exposed huge amount of variation, they are also fragmented and initial bid price is relatively lower. Whereas projects with design build are likely to be completed with scheduled budget cost and time, it is observed that variations are less even though initial project cost is high.

CHAPTER ONE

1. Introduction

1.1 Background

Roads are the back bone of a country's infrastructure and the frame of a country's economic development. They support growth in agriculture and industry, open corridors, port links and tourism areas, and connect each region to the rest of the country. Roads also furnish access to internal markets and social infrastructure such as schools and health centers.

During the 1936-41 Italian occupation, road building increased. Mobility helped Italy consolidate its rule over Ethiopia, initiate development projects, and pacify unstable areas. By 1941 there were about 7,000 kilometres of roads, of which about half were surfaced with asphalt. After liberation, road construction and maintenance stagnated because of lack of funds, equipment, and expertise until 1951, when the government established the imperial Highway Authority. With the help of World Bank funds and with technical assistance from the United States Bureau of public Roads, the development of Ethiopia's highway system continued.

The Imperial Highway Authority played a major role in the construction of roads until the revolution. The Derg restructured the Imperial Highway Authority as the Ethiopian Road Authority and Rural Roads Task Force. The government created the letter to develop rural roads outside the main system and to extend feeder roads with in the main system. The World Bank, which had financed four previous highway programs, funded this project. In addition, the African Development Bank provided assistance for road construction and maintenance. Despite these efforts, Ethiopia's road network remained primitive and quite limited, even by African standards.

In the 1990s, the government of Ethiopia knew that the major expansion of the road network was necessary to meet its development goals-namely, (a) advance the private sector; (b) upgrade and expand essential infrastructure; and (c) conserve the environment. With this in mind, Ethiopia's leaders formulated the10-year Road sector Development Program (RSDP 1997-2007), a two-phased integrated package of investments, and institutional reorganization. The program was later extended to include a third phase up to the end of June 2010. [1]

To help Ethiopian Road Sector Developing Program to be achieved using appropriate construction delivery method is an important factor. Actually Ethiopia is practicing the traditional methods (Design Bid Build) while there are other innovative delivery methods. These delivery systems are developed overtime, based on problem solving from the previous types of delivery system.

In Ethiopia since 1987 the design bid build DBB types of delivery system is practiced. This kind of delivery system divided the Project in to different package however, many constructions owners have experienced a verity of frustration using this delivery system due to: time consuming, its exposure to claims, it causes adversarial relationships, among the parties and also the absence of contracts inputs in the design decision.

The design-build DB delivery system starts practicing since 1970. The design-build DB delivery system will reduces fragmentation and only one procurement process and a single contractor provides the entire process. The DB project delivery system has grown in popularity, and is seen by some in the industry as the perfect solution in addressing the limitation of other methods. For an owner the primary benefit is the simplicity of having one party responsible for the development of the project.[19] in addition design team and contractor are procured together, providing a complete team approach, opportunity to fast track and save time, construction expertise is available from the beginning of design, leads to value engineering and constructability improvements from the beginning of the design process, allows ability to fast track the project from conception to occupancy, diminishes risk of need for re-design due to enhanced collaboration between owner, contractor and design team, less adversarial relationship between design and construction teams due to the fact that architect works for the contractor not the owner.[16]

1.2 Problem Statement

Ethiopian Road Authority has been using mainly design bid build delivery system since its establishment until now. Frequently observed problems in design bid build delivery system are like lack of input from construction company during the design stage exposes the contractor to claims related design and constructability issues and initial low bid might not result in ultimate lowest cost or final best value leads the projects could not been completed with budgeted cost, time and with the required quality.

There for these and others related problems that has been arise from design bid build the delivery system initiates me to study this paper and try to be address by latest type of delivery system which might be answer this research questions.

1.3 Research Question

What is the practiced delivery system Ethiopia road authority has been experiencing in federal road projects construction?

What are the existing problems that have been observed in design bid build delivery system in general? What are the problems associated with the design bid build and design build and in the contrary what are the advantages of design bid build and design build delivery method in projects that have been built by Ethiopian road authority?

It has been seen many times that projects owned by Ethiopian road authority could not be complete with budgeted cost, time and with the intended quality. Previous research explained that one major reason for this poor performance is mainly associated with the type of delivery system. What are weaknesses and strong sides of DBB and DB in Ethiopian road authority?

1.4. General Objective

- To see the existing delivery system in the construction sector in general
- To see distinct behaviour different delivery system that has been avail in construction industry.
- To see the behaviour and advantages of design bid build and design build delivery system in construction sector in general.
- To see the behaviour and the disadvantages of design bid build and design build delivery system in construction sector.

1.5 Specific Objectives

- To evaluate the advantages of design bid build and design build delivery methods in the road construction sector at federal level.
- To evaluate the disadvantages of design bid build and design build delivery methods in the road construction sector at federal level.
- To see weather projects met their budgeted time, cost and intended quality with respect to the delivery system that has been applied and to find out what are the root causes of these problems for un fulfilment.

1.6 Methodology

In order to achieve the objective of this study the following approach has been taken.

- Reviewing literature for supporting data
- Conduct an interview with key personnel from client(Ethiopian road authority), contractors and consultants in order to get information regarding the behaviour of the project delivery systems they use and their benefits and drawbacks they observed during the progress of the project.
- Conduct case study by taking two projects that has been built by Ethiopia road authority one with design bid build and the other with design build.

1.7 Significance of the Study

Currently different kinds of contract delivery system have been carried out in federal road projects and it is known that each delivery system has its own benefits and drawbacks. Significance of the study is to evaluate the major delivery system that has been applied in federal road projects i.e. DBB and DB and to recommend a relative better delivery method in terms of risk sharing among contracting stakeholders in federal road construction.

CHAPTER TWO

2. Literature Review

2.1 General Overview

Construction of road projects of governments covers a fairly large portion of their capital budget. Creating a large facility takes a long time and usually involves a large capital investment. At the very beginning of these projects, the decision is desired to be based on complete information with a higher degree of certainty of the outcome. However the world is full of unpredictable forces and undesirable outcomes. Hence most decisions are based on incomplete information with an associated level of uncertainty about the outcome. It is this uncertainty that leads to risk.

Risk is the effect of uncertainty on projects. It can come from uncertainty in financial markets, project failures, accidents, natural causes & disaster as well as deliberate attacks from an adversary. Risk management can therefore considered the identification, assessment and prioritization of risk followed by coordinated and economical application of resources to minimize, monitor, and control the probability and impact of unfortunate events or to maximize the realization of opportunities.

The ability to manage risk effectively and owners control over the project are among the most important factors for selecting the delivery method. The most appropriate project delivery method is selected early in the project life cycle based on a number of objective and criteria set forth by the owner.

Project delivery system is the way project owners together with project regulators and financiers determine the assignment of responsibilities to project stakeholders along the construction process. Using delivery system for project implementation is the major part of project cycle.[11] But first, what exactly is a “project delivery method”? All of us are familiar with how consumer goods are delivered, in a box on our front porch. We rarely think about the earlier steps that led up to our receipt of that box: the design of the product and its manufacture. Each of those steps is an essential part of the overall delivery Process for the product, but we don’t have to be involved in those steps. If we want a building built for us, however, it’s different: we have to be involved in the entire arc of delivery, from design

through construction. Building industry professionals use the term “project delivery” to refer to that arc, to the process that begins with design, proceeds through construction, and concludes with the building ready for our use[10]

There are various types of project delivery systems. Among these the most popular type of project delivery system in ERA is the DBB and for few projects DB method is used. Both methods are used by the private & public sector.

Some of the principles of project delivery system are value for money, competition, transparency and risk sharing.

Value for money; any investment should only be made if the project can be justified in terms of providing value for money.

Competition; fair competition insures that the client gets an economic project.

Transparency; most delivery procedures are relatively transparent so that there is confidence that the procedures are being implemented fairly.

Risk sharing; it has an advantage to provide the best environment for satisfactory performance of the consultant or contractor in the project delivery system. [11]

2.2 Risks in general

In implementing the project first the employer must identify the constraints which surround the specific project. These constraints may include financial, physical, geographical, time, functional or design.

From these the facility must decide how such constraints impact on the risk associated with the project. [3]

Risks are those factors where there is a probability if occurred and the outcome and cost is uncertain. Consideration of the factors which affect a project leads to the allocation of the identified risks between the employer and contractor.
All critical risks associated with a project should be appropriately allocated.

The identification and realistic allocation of a risk can lead to the inclusion of provisions in a contract to avoid argument over liability when such a risk arises. It also provides a process of payment to the contractor for the outcome of risks.

A risk to a contractor and realistically priced in a competitive tendering environment can leave the contractor with no choice but to inadequately allow for the risk, then seek compensation through the contract or at law when the risk occurs or, to alternatively overcompensate with a premium in the bid price.

The allocation of risk to the contractor will greatly affect the contract sum. It is the fundamental principle of contracting that the transfer of risk from one party to the other should be accompanied by a financial premium. Passing of many risks to the contractor will result in an inflated tender.[3]
So the question is how it is possible to manage these intricate risks.

2.2.1 Risk Management Mechanism

The general risks that occur on any project can be classified into some major areas, i.e. financial, time, design, and quality. Managing these risks usually begins by planning. Risk management planning proposes a way to tackle risk on the project. This step includes; defining objectives, identify risk, quantify risks, develop response, and risk control. [5]

After defining objectives and identify risks, probability of the risk occurring and the impact will be quantified. This determines which area of risk warrant a response, and also determines where resources are limited. Risks are prioritized in such a way that areas of risk, that should be addressed first, be determined. This may be done by plotting a probability impact matrix.

The next step following risk quantification is developing a risk response plan which defines ways to address adverse risk and enhance opportunities before they occur. During planning, there are responses which should be developed in advance. These are eliminating, mitigating/reducing, deflecting, and accepting risk. To eliminate the risk completely is the first natural sequence. If it is not possible to eliminate, reducing the risk will be the next.

Deflecting risk is a method of transferring risks to others through contracting, retention, bonding and insurance. This gives the chance to allocate the risk to the party who can manage it best.[8] if we associate risk with project alliancing should be used to deliver complex, high-risk projects, where risks are unpredictable, inherent to the nature of the project (rather than due to inadequate planning, scoping, or time), and best managed collectively. The project should also derive significant, benefit from the involvement of both the owner and non-owner participants in all aspects of project development and implementation.[15]

2.3 Construction Contract delivery System

2.3.1 Contract delivery System

Project delivery system is the way project owners together with project regulators and financiers determine the assignment of responsibilities to project stakeholders along the construction process. Using delivery system implementation is the major part of project cycle.

Here under we are going to discus different types of delivery systems mainly DBB & DB delivery methods. In each of the methods we sort out their advantages & disadvantage for both the owners & the contractors. The purpose to discuss these methods is to select the best delivery methods between them. The major difference between the various delivery methods are the way in which they allocate risk among the contractor & the employer.

2.3.1.1 Types of contract delivery system

Generally, there are four types of Contract Delivery systems. These are:

- Force Account
- Design Bid Build (DBB)
- Design Build (DB) or turnkey
- Finance /Build Operate and transfer System (BOT)

a) Force Account

When the Project Owners engage themselves to undertake the project, it is called a force account delivery system. Often such a system is promoted if the Project owners believe that there is a comparative advantage in Cost, Time and Quality issues. Besides, when there is a lack of capacity from the private sector to undertake very large and technologically new projects, public companies do undertake such projects using Force account delivery systems.

b) Design Bid Build (DBB)

This is the most practiced type of delivery system in the construction Industry of Ethiopia since the 1987. After project owners did prepare the basic planning that identifies construction project programs, they call upon the participation of design and / or supervision consultants either by tender or by negotiated contracts. This consultant will carry out the design together with the necessary tender documents which will be the bases for tendering to select contractors. These process is called Design - Bid - Build and hence the name for such delivery system. [19] or in other term it can also defined as the most traditional and most common process where the project develops in sequential steps of design, bid and then build. The owner contracts with the designers who design the project. Once the project is fully designed, it is bid to numerous contractors. A bidder is selected and the owner contracts with the contractor to construct the project.[4]

C) Design Build (DB) / Turnkey

Design Build or Turnkey Delivery system is a response to problems associated to the last two types of delivery systems. These were promoting privatization and its businesslike approach to enhance the Force Account System and reducing fragmentation, adversarial relations and Project Owners' risk which are recurrent manifestations in the DBB delivery system.

Design Build or Turnkey by principle reduces numbers of procurement processes engaged in the fragmented process and employ only one procurement process and a single contractor to provide the entire construction Implementation Process (Design and Construction Implementations). In the 1970s, large firms began to offer both design and construction services in order to provide project owners with a single source for project delivery. At the beginning, this delivery system was limited to complex projects such as industrial, big plants and big infrastructural constructions.

DB delivery system is common worldwide specifically for private projects. This leads contracting firms to form a team or consortium of designers and specialty contractors who work together to meet the entire demand. Such services are initiated after the project owner built the project concept during the basic planning phase and brought to the DB Contracting Firms. The project concept should clearly define the performance criteria such as output, input, waste and any other performances the employer may desire. This makes an additional responsibility to the contractor which is ¨fitness to purpose¨ according to the Orange Book of FIDIC. Fitness to purpose is beyond the professional duty of care and places liability on the contractor for any failure of the design to perform

the standards required. [19] Sometimes it can define as the functions of design and construction, but in addition the design-build entity takes on some responsibilities of real estate development. Also known as turnkey construction or (occasionally) sale/lease-back, this method is characterized by the legal transfer of title to real property. It is distinct from speculative development, because an owner initiates the process and contracts for services with the design-build entity. Typically, the design-build entity maintains and operates the building long enough after completion to ensure that all systems are functioning properly, then transfers legal title to the owner.[10]or in other words On many construction projects, particularly in the private sector, a General Contractor is hired on the basis of his knowledge, experience, resources, assigned personnel and fee to participate in the project during the design phase as well as during construction. Under this arrangement, the General Contractor can provide services such as estimating, cost analysis, scheduling, value engineering, etc.

During the construction phase, the negotiated General Contractor operates in a more conventional role, usually performing certain trade work with his own construction forces. However, here too the Contractor, Architect and Owner function more as a collaborative team than under a more conventional competitively bid process. [8]

Typical advantages of this system include:

- reducing fragmentation and adversarial relations between designers and constructors;
- minimizing Project owners' risk transferable due to Designers' faults;
- accountability and entire responsibility for both design and construction which entitle the employer to receive completed project is onto a single contractor;
- employers' responsibility to co-ordinate interfaces between different project elements is avoided;
- single point responsibility minimizes the opportunity to claims by the contractor due to design related issues;
- coordination between design and construction processes will also be enhanced (both in communication for constructability as well as in fast tracking); and
- The client budget or financial requirement is defined early enough in the development process.

For this type of delivery systems, either joint ventures or firms with large design and construction capabilities were able to participate.

The disadvantage of this delivery system is loss of control, cost of tender and cost of risks.

- Since limited supervisory role by the employer representative is practiced; which is relatively flexible and makes the employer distanced from the whole process, the employer has little chance to understand what is developed and entertain variations in requirements implying loss of control.
- Contractors in order to provide reasonable offer, their tender cost is higher than in the case for DBB delivery system. This is because they need to carryout acceptable design for project cost offers. Though it was not practiced often, employers who shared costs related to tendering are informed to get seriously considered offers. World Bank suggested a Two staged procurement method based first on technical merit and followed by financial competition and not for more than six bidders.
- The increase in risk transferred onto the contractor will be counterbalanced by the increase in contract prices which can be taken to include these costs of risks.

Projects carried out using DB delivery system are often called Turnkey Projects because a single contractor is responsible to hand over the completed facility and let the Project owner to turn the key and gets in. Often Turnkey projects use Lump-Sum contract type.

d) Finance / Build Operate Transfer (BOT)

Build - Operate - Transfer is a form of procurement and contract delivery system that promotes Public Private Partnership (PPP) in which a private company is contracted to finance, design, construct, and operate for a certain period (usually 10 years) and transfer. BOT contractors look to project financiers for the realization of projects through equity contributions or credits. Such provisions are different from budgeted finances such that they involve no or limited re – course which means the project owner is not responsible for any liability other than force majeure and agreed upon claim adjustments. This obliges that projects should first be viable for revenue generation in order to payback its debts.

The Typical BOT contract is the process whereby a government grants a concession to a project development company to develop and operate what would normally be a public sector

project, for a given period of time known as the concession period. BOT project involves a potentially complex contractual structure. The Operation period between completion and transfer gives the contractor an opportunity to verify the quality of the output of the services and works, and train the employer personnel on how to manage the facility afterwards. In some BOT contracts, defect liability period will be included in order to ensure the quality of the facility during transfer. This is because, operators in an attempt to save costs, may decrease operating and maintenance expenditures towards the end of the concession period.

This delivery system is advantageous because of three major factors: it minimizes owners' scarcity of financial resources; It devoid of considerable risks from the project owners and lesson regulatory activities; and The facility is well operated and transferred with free of charge or minimum compensations to project owners.

Such delivery system requires appropriate packaging of projects and their definition clearly. It is advisable to start with small projects and tries to develop experience and expertise to make such delivery system successful. Most BOT projects failed because of their built up and engagement in very large projects which is an extremely risky business for contractors. Consortium of contractors is used to carry out such projects. The increasing popularity of the BOT project is largely due to a shortage of public funding and the opinion that the facility will be more efficiently managed by a private entity.[19]

2.3.2 Criteria for Selection

The appropriateness of any given project delivery system varies, depending upon the project goals, time constraints, cost constraints, party at risk, and existing site conditions. Project owners should investigate each alternative and its or failure, on a case-by-case basis.

Project owners generally want the same thing: construction at the lowest cost, of the highest quality, and done within the shortest period of time. Some goals, however, may take precedent over others. The speed of implementation, for example, may be more important than cost on certain projects. For others, maintainability and low life-cycle costs may be more important than initial cost. Owner control of the design and/or construction may be important

for some, while, for others, limiting the risk of costly changes is paramount. Goals to consider include:

- Lowest cost consistent with quality and performance objectives
- Initial cost versus life-cycle cost
- Shortest schedule for overall project delivery
- High quality
- Comply with technical specifications
- Meet overall expectations
- Promotes innovation and value engineering
- Limit the cost of design changes
- Limit the risk of cost and schedule growth
- Control over design decisions
- Control over construction quality
- Limit impact on current operations, safety, security
- Limit demands on owner resources
- Limit number of contractual entities/points of responsibility
- Limit claims for additional cost

When selecting an appropriate project delivery system, first define the goals and objectives for the project, and define any unique issues that could significantly impact it. Then rank these goals, objectives and issue in order of priority and importance, and match them to the strengths and attributes of the various project delivery systems. For example, some projects may be challenged by frequent design changes or by other potential disruptions. The selection of a project delivery system should take these issues into account. Also, project owners must recognize the various trades-offs relating to cost, time quality, control and risk, and select a project delivery approach that provides the proper balance.

There are various types of project delivery systems. Among these the most popular type of project delivery system in ERA is the design bid build and for few projects design build method is used. Both methods are used by the private and the public sector.

Currently the government implements road projects through private sector as a means of delivering road infrastructures.

Implementation of projects through the private sector has an advantage of lowering overall project cost by managing cash flow and doing the job more efficiently while; the public sector has finance capacity and retain the ownership of infrastructure. [19]

This part of the project paper discusses two methods of project delivery namely design bid build and design build method. Each of the method has distinct advantage and disadvantage for both the owner and the contractor. The major difference between the two delivery methods are the way in which they allocate risks among the contractor and employer. The purpose to discuss these methods is to select the best delivery method between them mainly on road projects.

2.4. Comparison of DBB and DB contract delivery method

2. 4.1 Design-bid-build

Design bid build (or design/bid/build, and abbreviated D-B-B or D/B/B accordingly), also known as design-tender (or "design/tender"), is a project delivery method in which the agency or owner contracts with separate entities for each the design and construction of a project

There are three main sequential phases to the design-bid-build delivery method:

- The design phase
- The bidding (or tender)phase
- The construction phase

2.4.1.1 Design Phase

In this phase the owner retains an engineer for infrastructure works to design and produce tender documents on which various general contractors will in turn bid, and ultimately be utilized to construct the project. For construction projects, the engineer will work with the owner to identify the owner's needs, develop a written program documenting those needs and

then produce a conceptual or schematic design. This early design is then developed, and the engineer will usually bring in other professionals including high way, mechanical, electrical, and plumbing engineers (MEP engineers), a fire engineer, structural engineer, a civil engineer and often a landscape architect to complete documents (drawings and specifications). These documents are then coordinated by the engineer and put out for tender to various general contractors.

2.4.1.2 Bid (or Tender) Phase

Bids (tenders) can be "open", in which any qualified bidder may participate, or "select", in which a limited number or pre-selected contractors are invited to bid.

The various general contractors bidding on the project obtain copies of the tender documents, and then put them out to multiple subcontractors for bids on sub-components of the project. Sub-components include items such as the bridge work, earth work excavation, concrete work, structural steel frame, electrical systems, and landscaping. Questions may arise during the tender period, and the designer will typically issue clarifications or addenda. From these elements, the contractor compiles a complete "tender price" for submission by the closing date and time. Tender documents can be based on the quantities of materials in the completed construction such as bills of quantities, or the operations needed to build are as in operational bills.

Once bids are received, the engineer typically reviews the bids, seeks any clarifications required of the bidders, ensures all documentation is in order (including bonding if required), and advises the owner as to the ranking of the bids. If the bids fall in a range acceptable to the owner, the owner and engineer discuss the suitability of various bidders and their proposals. The owner is not obligated to accept the lowest bid, and it is customary for other factors including past performance and quality of other work to influence the selection process. The project is usually awarded to the lowest bid by a qualified general contractor.

In the event that all of the bids are in excess of the goals of the owner, the owner may elect to reject all bids. The following options become available:

- Abandon the project.

- The engineer may revise the design at no cost to the owner, making the project smaller or more efficient, or reduce features or elements of the project to bring the cost down. The revised documents can then be re-tendered.
- The owner may elect to select the lowest qualified bid's general contractor to join the architectural team to assist with cost reduction.

2.4.1.3 Construction phase

After the project has been awarded, the construction documents may be updated to incorporate addenda or changes and they are issued for construction. The necessary approvals must be achieved from all jurisdictional authorities for the construction process to begin.

The general contractor often provides work with its own forces, but it is common for a general contractor to limit its role to management of the construction process and daily activity on a construction site.

The designer acts as the owner's agent to review the progress of the work and to issue site instructions, change orders or other documentation necessary to the construction process.[10]

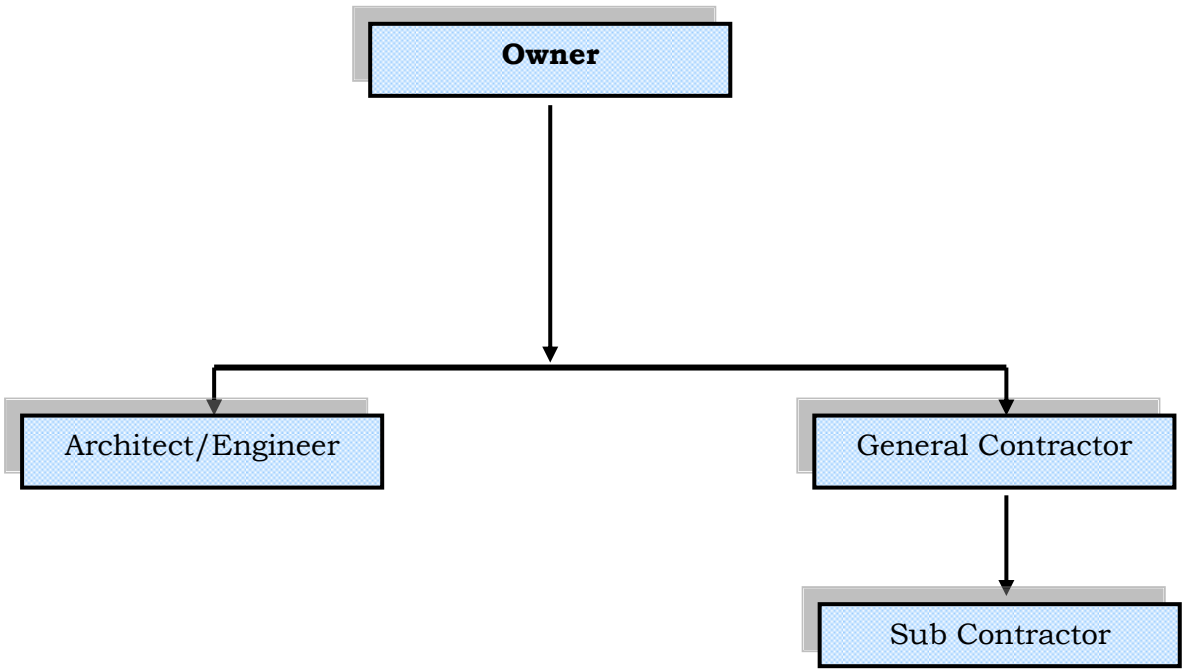

Fig-2 Typical DBB Structure

2.4.1.6 Advantages of Design-Bid-build

a) Construction is fully defined:- With design-bid-build, the facility the owner wants is fully defined by detailed working drawings and specifications before bids are solicited. This means there is little uncertainly about what the owner wants and what the contractor is required to deliver.

b) Competitive bidding results in lowest costs:- With design-bid- build, the contract is awarded to the bidder who offers to construct the road for the lowest price. This competition motivates bidders to offer the lowest price they can because they know price is the only basis for award of the contract. Also, since the road the owner wants is fully defined by detailed working drawings and specifications, bidders do not need to increase their bids to cover contingencies that might arise if a road is not fully defined.

c) Relative ease of assuring quality control:- Quality in a construction project is controlled using detailed working drawings and specifications, which are the basis of the contract between the owner and the contractor. This allows owner's supervisor to compare the materials and workmanship of the project under construction with what are required. If the requirements are not met, provisions of the contract can compel the contractor to correct the work. Without detailed working drawings and specifications, there is little an owner can do to control the quality of the contractor's work.

d) Objective contract award:- Awarding construction work, which represents about 90 percent to 95 percent of the road cost, by competitive bidding, uses an objective criterion on lowers cost. This reduces the opportunity for bias and inappropriate influence to play a part in awarding the construction contract. The smaller architect/engineer contract (representing about 5 percent to 10 percent of the road cost) is awarded based on subjective criteria of experience and qualifications because it is for profession services that cannot be defined in detail before the road is designed.

e) **Good access for small contractors:-** By awarding contractors based on price, the design-bid-build process provides the best opportunity for qualified small and new contractors to obtain government contracts. Small and newly established contractors may be able to perform work at a lower cost than large competitors because of lower overhead and more efficient operations. [19]

f) As construction features are typically fully specified, DBB provides agencies with significant control over the end product (however, this may come at the expense of increased agency inspection efforts), Discourages favouritism in spending public funds while stimulating competition in the private sector .[15]

2.4.1.7 Disadvantages of design bid build

a) **Owner gets involved in conflicts and disputes:-** design and construction of a road is a complex and difficult undertaking. There will always be conflicts and disputes that can lead to time-consuming and expensive legal action, no matter what construction delivery process is used. One major source of conflicts is errors and omissions in the working drawings and specifications prepared by the architect/engineer/. In the design-bid-build process the public agency hires the architect/engineer directly, and the law holds the owner to be the guarantor of the completeness and accuracy of the architect/engineer's work. This draws the owner into disputes between the designer and builder and frequently subjects it to significant liability.

b) **Builder not involved in design process:-** with design-bid-build, the builder is not known until after the design work has been completed, bids have been submitted, and a construction contract awarded. This means the design cannot incorporate any input by the construction contractor on construction materials and methods that could improve the road's design, functionality, and cost.

c) **May be slower:-** the design-bid-build process is usually slower than the design-build process, mainly because of the sequential nature of the process. In contrast,

under design-build, design and construction work may be undertaken concurrently. (This difference, however, may not be significant in the case of larger projects because procurement using subjective criteria of experience, qualifications, and best value often requires substantial time to allow competitors to prepare proposals and owner officials to evaluate them.)

d) Price not certain until construction bid is received:- with design-bid-build, the architect/engineer firm prepares cost estimates as the design work processes, typically when the working drawings and specifications are about 10 percent, 35 percent, and 100 percent complete. While this gives the agency an early indication of the project's cost, there is no cost certainty until design is completed and construction bids have been received.

e) Agency may need more technical staff:- design-bid-build requires the completion of detailed working drawings and specifications before bids are solicited, and then a substantial inspection and quality control effort during construction. This may require an agency to employ a substantial number of technical staff to manage larger design-bid-build projects. [19]

f) Lack of input from the construction industry during the design stage exposes the agency to claims related to design and constructability issues

g) Tends to create an adversarial relationship among the contracting parties, rather than foster a cooperative

h) atmosphere in which issues can be resolved efficiently and effectively

i) No built-in incentives for contractors to provide enhanced performance (cost, time, quality, or combination thereof). .[15]

2.4.2 Design Build

Design-build (or design/build, and abbreviated DB or D/B accordingly) is a construction project delivery system where, in contrast to "design-bid-build" (or "design-tender"), the design and construction aspects are contracted for with a single entity known as the design-builder or design-build contractor. The design-builder is usually the general contractor, but in many cases it is also the design professional (architect or engineer). This system is used to minimize the project risk for an owner and to reduce the delivery schedule by overlapping the

design phase and construction phase of a project. Where the design-builder is the contractor, the design professionals are typically retained directly by the contractor. The most efficient design-builder has design and construction professionals working directly for the same at-risk entity. This is one of the oldest forms of construction since developing from the "Master Builder" approach.[17]

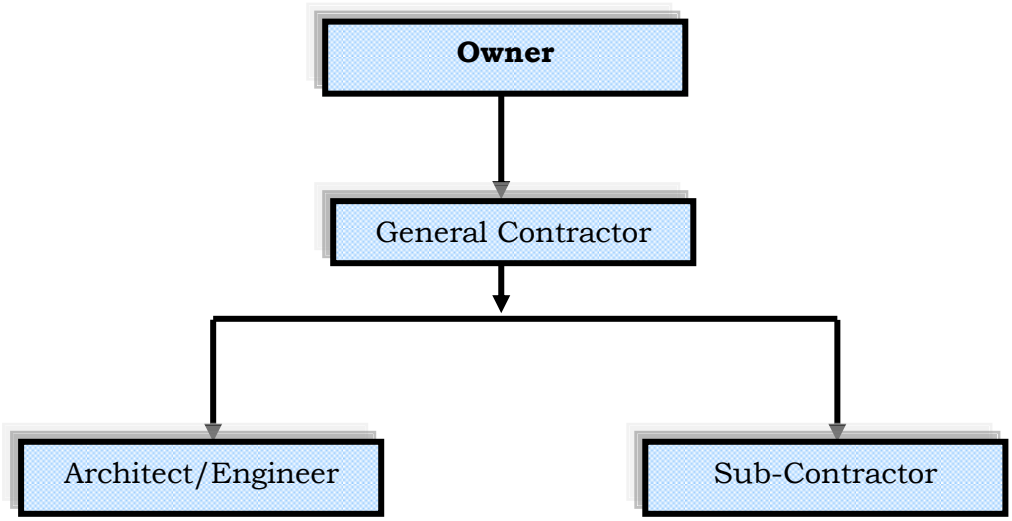

Fig-3 Typical DB Structure

2.4.2.3 Roles and responsibilities of parties in DB

a) The Client

Without a client a project would never get off the ground. The client identifies a need for the Project.

When the details of the project have been finalised the client engages a Contractor to execute the works, ensures the land is available for the works to be constructed, and makes payments to the contractor at regular intervals.

When a client does not have sufficient funds to cover the whole cost of the Project, he will have to have access to additional sources of funding. This may be in the international money market, or he may approach one of the international or national funding agencies such as the World Bank, the African Development Bank or bilateral agencies who promote such projects.

When a project is funded by an international agency the client is normally the government of the country concerned, but in practical terms may be a single entity within the government. The responsibility for the securing the finance and the loan agreement will most likely be

with the relevant finance ministry or department, as the implementation will be the responsibility of the appropriate functional ministry or department.

Having identified the need for the Project the client will carry out the initial studies, investigations, prepare an employer requirement and procure a contractor. This appointment is generally made by advertising for interested companies to submit an Expression of Interest with details of their experience and capabilities; from these a short-list of companies is selected (usually 5 or 6), who are then invited to submit formal Proposals. These Proposals are then evaluated for both their technical and financial acceptability and the optimum applicant appointed.

However during the stages before appointment of a contractor there will be many issues identified by the client during the course of his studies, which will require decisions.

The client usually carries out the identification of a Contractor to whom the design and construction contract should be awarded.

The client's primary responsibilities are to ensure that the Site where the works are to be executed is available for the Contractor when required, that issues related to other external bodies that affect the project are resolved (relocation of utilities, etc) and that payments are made on time in accordance with the requirements of the Contract. These issues can however have major and serious consequence if the Client fails in his duties.
During the course of the Contract the Employer's duties and responsibilities are limited to the following:

- Appointing the Contractor.
- Providing access to the site for the Contractor to undertake the works.
- Making of payments to the Contractor
- Responding promptly on matters for which the Engineer is required to consult the Employer before issuing an instruction, determining an amount to be added to or deducted from the Contract price or granting an extension of time.
- Approving of securities, insurers and terms of the insurance policies
- Taking over the works once substantially completed
- Deducting liquidated damages from monies due to the Contractor when payable

- Terminating the Contract in the event of the Contractor failing to perform

b) The Contractor

The role of the Contractor is to design, execute and complete the Works, for which he has submitted his Tender, within the time specified in the Contract. In addition he has an obligation to remedy any defects which appear during the Defects Liability Period. He is also responsible for the design and specification of the Permanent Works.

The Contractor is responsible for his own staff and work force and for taking out social and other insurance in respect of his personnel. He must comply with all laws and regulations and ensure that all those for whom he is responsible also comply.

In the event of default by the Employer, the Contractor may suspend the progress of the Works or reduce the rate of work and claim an appropriate extension of time and/or compensation for loss of income/profit.

The Contract requires the Contractor to superintend the design and construction of Works either by being present in person or by appointing a competent and authorised person to act on his behalf. Superintendence involves the active direction of the means by which the Works are carried out. This is distinct from the task of the Engineer's Representative to supervise, which involves control over what will be accepted into the Works. Superintendence, as far as civil engineering construction is concerned, involves the active direction of the means by which the Works are carried out. This covers:

- Manage the design and construction team
- Organising resources
- Ordering materials
- Programming tasks
- Setting targets for both productivity and costs

Superintendence is necessarily more active and positive, as it is the Contractor who has agreed to design and construct the Works for the Employer. The Contractor strives to ensure

that he complies with the requirements of the Contract in such a way that its costs are minimised.

c) The Employers representative

The employers representative shall carry out the duties specified in the contract and shall have no authority to amend the contract and relieve the contractor of any of its duties, obligations or responsibilities under the contract.

The employer's representative shall copy to the employer all communication given or received by him in accordance with the contract.

Follow, control and monitor the constructability of works according to the approved or accepted designs. And also give instructions in accordance with the contract to the contractor. If agreement is not achieved, the employer's representative shall determine the matter fairly, reasonably and accordance with the contract.

The employer representative mainly check and approve the designs made by the general contractors, and also check the designs are according to the employer requirement and ERA'S design manual. [17]

2.4.2.6 Advantages of Design build

a) **Price certainty:-** with the "stipulated price" method of implementing design-build, an owner has the best certainty of the cost of the road at the outset of the project. This is because the owner specifies what it is willing to pay for a road before it solicits proposals from design-build contractors for the configuration, features, and materials they are willing to provide for the specified price. The risk with this approach is that the owner may not get the best quality road for the price it pays.

b) **Project owners may avoid conflicts and disputes:-** because the designer and builder are part of the same design-build entity and the public agency is not the guarantor of the completeness and accuracy of the work of the architect/engineer, the owner may avoid conflicts and disputes that can arise between the architect/engineer and construction contractor.

c) **Builder involved in design process:-** the construction contractor is involved in the design process from the beginning and can provide helpful insights on

construction material and methods that can make the design more efficient at less costly to construct.

d) **Faster project delivery:-** by overlapping design and construction to some extent, and by potentially reducing conflicts between designer and builder, design-build can usually deliver a project faster than the design-bid-build approach. With large projects, however, this may be less of an advantage because of the extra time needed for competitors to prepare their statements of qualifications and technical proposals.

e) **Project owner needs less technical staff:-** under design-build, the public agency does not have to review the accuracy and completeness of the architect/engineer's work. Thus, the owner may have less need for in-house technical staff to manage projects.[19]

f) Designers and contractors working together, Can begin construction of project while still in design, Lowers the TOTAL project cost over the life of the project, instead of just focusing on the lowest cost to construct .[6]

2.4.2.7 Disadvantages of design build

a) **Limited assurance of quality control:-** because the road the owner wants is not defined in detail at the time it enters into a contract with a design-build contractor, there is limited basis for enforcing contract and the owner may have little control over the quality of the construction work.

b) **Subjective contract award:-** with design-build the design and construction work generally is awarded based on subjective criteria such as experience, qualifications, and best value. owners have established contractor evaluation and selection process and policies to try to mitigate the risks of subjective judgments, but drawbacks still exist, such as:

- **Public managers have discretion in awarding "points":-** Owners frequently use a points system. The number of point's public official's

award to competing firms on various criteria is arrived at subjectively. There is no objective way to determine the correct number of points to award a competitor on a given criterion. For example, there is no objective way to determine that one contractor's "waste management plan" warrants "10" points and another's only "8".

- **Criteria do not relate directly to specific road being procured:-** while evaluating contractors based on qualifications and experience provides a measure of contractors' competence, it is not a guarantee on the project outcome. This is because under design-build a especially design road is not the "deliverable".

c) Limited access for small contractors:- because design build contracts mostly are awarded based on qualification and experience, this method may tend to work against small, newly established contractors, who do not have the range of experience of large, long-established firms. As a result, access to design-build contracts, especially the large contracts, may be limited for these contractors.[17]

d) Owner has less control over design details, Owner must clearly define scope prior to entering into contract (risk of creep), Owner must have extensive construction experience.[12]

CHAPTER THREE

3. Interview Findings and Case Study

3.1 Case study and Interviews

I have conducted a case study on both DB delivery system and DBB delivery system. In which each one of the projects has been completed. I had also conducted an interview with key personnel's in different stakeholders. Answer for an interview questions have been listed as follows.

3.1.1 Interview with employers (ERA)

A. Time related problems

Most of the respondent said that the time construction projects ended up with delay. For this problem many reasons can be mentioned. The major causes of delay related to DBB delivery methods are mostly caused by incomplete design during implementation. Design related problems which include setting out problem, inadequate investigation of site condition, inadequate (missing) detail on the drawing and selection of right off way.

The other causes of delay is during implementation contradiction occurs between contract documents and occurrence of variation in the contract nature of work, non removal of right of way, obstruction on time, lack of collaboration between stakeholder, ambiguities, mistakes and inconsistency in design document, contractors management problem, lack of appropriate and consistent follow up by the consultant, delay in making decision by both the employer and consultant, request for proposal or realignment, late instruction order by the engineer and lack of experience in the area. In general most of the respondent said also that there is large portion of relation between road projects delay and with the project delivery system they use.

B. Cost related problems

From the interview most respondent said that ERA (Employers) cost overrun faced in many projects. DBB delivery system has some contribution in using incomplete data collection during designing road by the designers which ended up with delay that gives also cost overrun. The other common problems price escalation and change in requirement by the time of implementation creates (cause) cost overrun.

C. Problem related to DBB and DB delivery method

Most respondent believed that Design-Bid-Build delivery method frequently faces problem of poor quality design, variation in quantity, in sufficient communication between employer and designer, problem of consultant to prepare and deliver a good quality of design and contract document, there are a lot of problems regarding to variation claim and dispute, to long leading time for design, bid and construction.

In design -build delivery method since it is a relatively new delivery method to our country. Limited knowledge and experience has been seen both from the contractor side and from employer too which leads to time and cost overrun. Also higher tender cost, lack of teamwork between the consultant and contractor limitation for variation, there is a little knowledge in standards document preparation and during evaluation. Procurement time is not adequate as it should be for the design stage, the contractors do not see the employer's requirement in depth and they have limited knowledge about ERA's design manual.

D. Selection Criteria for DBB and DB delivery method

Even if we have a better knowledge and experience on the traditional delivery system (DBB), the employers (ERA) nowadays tends to prefer the Design-build delivery methods for the federal road projects. It is mainly because of urgency. Knowing that we have limited experience on the DB system, in the near future they believe that the DB system will give a better life cycle cost and within a short period of time. In general the selection criteria for DB is urgency and life cycle cost.

E. Risks faced by contractors and employers

Most of the time employers are risk takers during design bid build for design risks, quantity variation, and the contractor takes the risk of workmanship problem.

During design and build most of the time design risk and workmanship problems are absorbed by the contractor and inflexibility to issue a variation, short time for decision and high tendering cost risks are absorbed by the employer.

3.1.2 Interview with the contractor

A. Time related problems

- From contractor perspective, the main causes of project delay are occurrence of huge amount of variation in the contract, right off way problem, lack of collaboration between stakeholder, existence of ambiguities within the contract document, contractors management problem, lack of appropriate and consistent follow up by the consultant

B. Cost related problems

- Contractors and consultants sometimes understand the ERA'S specification & design manual in different ways and are not detailed enough to the required level to give common understanding as a result it causes cost overrun.

C. Problem related to DBB and DB delivery method

- Assurance of quality control, construction progress control most of the time faced by the contractor in design bid build delivery system.
- On the other hand in design build delivery system like DBB the contractors also face the same quality and construction progress control problem further more they face design progress and cost control problems

D. Selection Criteria for DBB and DB

- The contractor benefits in DBB delivery system is that they pays energy to the control of the progress of the construction because the design is already finished on the tender stage. The contractor only supply detail drawings based on the former design
- In DB delivery system design and construction has been takes place simultaneously from this the contractor benefits good quality and better construction progress.

E. Risks faced by the contractors and employers

- In DBB the contractors risk are projects are delayed for various reason. From the employer's point of view the risks are faced cost overrun for variation due to design change.

3.2 Discussion and analysis of case study

3.2.1 Case study

In this study two federal road projects will be discussed. One project under design bid build and the other projects is under design and build projects awarded for least bidders after a prequalification screening. The procurement process was based on international competitive bidding to pass the qualification stage in ERA.

3.2.2 Design bid build project

Nekempt-mekenajo Road up grading Project

General Description:-

Nekempt-mekenajo road upgrading project is located in the western part of the Ethiopia in Wellega Zone of Oromiya National Regional State. Located at a distance of 330km away from Addis Ababa. It is one of the cash crop production areas in the country. Previously existing road was gravel surfacing and it was difficult to drive a vehicle. The road project comprises flat, rolling and hilly terrain. The project has been realized with the intention to promote the economic growth and it acts as a major catalyst in reduction of poverty in the Oromia region on completion of upgrading. The riding quality of the road improved to all weather road standards. The proposal includes widening and upgrading of pavement from gravel to asphalt concrete level and drainage facilities. The accessibility to the Benishangul-Gumuz Region, which has large untapped agricultural and mineral resources, will be considerably augmented. The road links two major towns Nekemte and Gimbi. It starts at Nekemte which is located 330km from Addis Ababa and ends at a village, Mekenajo. The total length of the project is 126.35km. The road connects five villages or town in the area Diga, Arjo, Jogir, Ihud gebeya and Gimbi.

The terrain characteristic of the existing deteriorated gravel road is classified as flat and rolling except 4 km from 77+800 to 81+200 where the road corridor crosses mountainous terrain. The terrain of the proposed route is flat for 50% of project length, rolling for 47% and mountainous for only 3%

The contractor was **Sino hydro corporation**, **China** and supervision consultant was carried out by span Stanley (IV) consultant.

The commencement date of the project was August 25, 2004 and the duration of the contract period is 1279 calendar days or (about 42 months). The project completion date was Feb. 24, 2008. The original contract amount was ETB 300,723,746.00. The project was completed on October 12, 2009.

Discussion

The project initial cost was ETB 300,723,746 and the final cost was ETB 407, 367,271. It was expected to be completed in 42 months. But due to several reasons the project got completed in 17 additional months. The causes of delay of the project in some cases it is related to the delivery system are due to variation order which is for Gimbi additional work issued by the employer, due to variation on culvert and changes on sub-base thickness.

The contractor has submitted a claim for 510 calendar days of extension of time for the cause of delays and it is extended to a revised completion date of October 12, 2009.

Design bid build delivery method give freedom for variation, for this reason the work increase in quantity of earthwork as a result time is extended.

The benefit of following this delivery system is tendering cost is relatively lower.

3.2.3 Design build project

Alamata-Mehoni-Hewane road upgrading project

General description

The project is located in the southern zone of national regional state of Tigray. The total length of the project is 114km. the objective of the project to upgrading of the existing gravel road. The existing road starts from Alamata town on Addis Axum trunk road (600km from Addis) crosses through predominantly flat agricultural land for nearly 59 km and negotiate

the remaining a predominantly mountainous terrain with occasional small stretches of rolling and escarpment terrain.

The contract amount was signed on Jan. 8/2008 between ERA and CCCC with a total contract price of ETB 645,000,000.36 including VAT. The commencement date was on Jan. 22, 2008 and the contract completion is 54 months from the date of commencement of works. To perform this project the contractor CCCC is in charge of construction design Share Company in joint venture with civil works consulting engineers with a contract lump sum price of Birr 5,657,894.74 including VAT

Discussion

The project has been completed with the price of ETB 685,000,000 that means it was completed with the extra 40,000,000 ETB from the original contract price. In addition actual project completion period was 60 months that means extra 6months needed due to right of way problem that has been arose around in the town of Mehoni and the other reason is undesirable weather condition that means the project completion date was January 24, 2013.

CHAPTER FOUR

4. Analysis and discussion of interview and its findings

Based on the answers given by the respondents (professional who participated in the project) the following findings can be summarised.

A. Causes of project delay

From the employers (ERA) point of view most the respondents argue major causes of delay of project in design bid build are mostly related with design problem, and variation of works, in adequate site investigation, and missing detail on the drawing. Inadequate site investigation during the design stage causes poor design and variation of works. Mostly in design bid build delivery method the design is prepared by the design team without appropriate site investigation. The design team doesn't give much attention because the risk is not absorbed by the team. As a result during implementation variation, change of design, missing detail in the drawing and change of design occurred, which causes delay of projects.

Some of the respondents argue that in design bid build projects usually lacks collaboration among stakeholders due to separate responsibility between contractual parties which causes delay.

As i observed from the case of Nekempt-Mekenajo road upgrading project the main cause of delay was variation which is mostly occurred in design bid build.

During design and build project delivery method, delays may occur due to underestimation of quantity and contractors not being familiar with ERA's design manual. Most of the time the occurrence of variation on this delivery method is minimized due to single responsibility for both design and construction. From the case of Alamata-Mehoni-Hewane road upgrading project, I have observed that delay occurs due to difference between ERA's requirement and contractor's design. The contractor doesn't have enough experience and awareness about design and build project delivery method.

B. Causes of cost overrun

Most respondents think that the cause of cost overrun also the causes of delay as mentioned above in addition to this price escalation is also the cause of cost overrun. From the cases it is seen that mainly cost overrun is occurred due to the cause of delay. While in design and build the occurrence of variation is minimized; the contractor will make a better solution for the problems because of the risks absorbed by him. But if the contractor doesn't estimate quantities with enough accuracy to submit sufficient bids, the cost overrun will be high and the risk is absorbed by the contractor.

C. Problem faced due to the use of design bid build and design and build

From the employers (ERA) point of view, most problems that has been faced was due to design bid build arose from insufficient communication between owner and designer during design stage, loss of surveying data (bench mark) and design problem (the design is not at required standard), underestimation of quantity, which leads the projects for variation, claim and dispute, that bring delaying of projects. And there is a problem of consultant to prepare and deliver a good quality or design and contract document. The employers (ERA) also responds that they don't have documents for quality assurance and quality control certificates for evaluating the previous projects with the current project to avoid repetition of problems.

During design and build employers (ERA) faced a problem of less number of bidders for tendering and higher tendering cost because of high risk allocation of contractors and the employers (ERA) do not have an experienced & coordinated team for proper administration of contractors claim. The contractors cannot manage their risk because local contractors didn't build their capacity and have a limited knowledge for design and build. During tendering the contractors will bid with under estimate cost due to inadequate design period given to contractors and without proper study of employers requirement don't follow up ERA's design manual. As a result, it is very difficult to implement design and build. The problem employers faced is limitation for variation due to absence of unit rates, evaluation procedure documents for checking the design and standards during tendering.

D. Selection criteria for design bid build and design and build

Most of the employers (ERA) respond that the criteria that has to be used to select design and build or design bid build depends project goals, time constraints, cost constraints, party at risk, and existing site conditions.. As we observe that currently the criteria to select design and build is by urgency that ERA has desired to construct many road infrastructure in a short period of time. But projects those are not more complicated and demand longer execution time they usually follow the design bid build delivery methods because they believe it is relatively cheap for them to apply this kind of delivery method.

E. Benefits of using design bid build and design build for project implementation

Most employers (ERA) respond that design bid build is the most practiced and adapted in their company it is easy to administer and resolve risks. This is due to experienced knowledge of contracting parties and they got many number of bidder for tendering based on their defined standard quantities and unit rates. This have a good capacity due to its tendering cost and the employer also have freedom for any kind of variation at any time because of its flexibility.

Most employers (ERA) responds that projects that are implemented by design and build are at early stage and do not fully complete. As a result, other than its theoretical benefits they could not found out its practical benefit of this method. However, ERA takes the initiative to have some experience, which helps them for the best future works in the next phase of the project

G. The risks faced by using design bid build and design build

Most of the employers (ERA) argue that in design bid build most of the projects are exposed to variation and increased in initial cost, that the risk is absorbed by the employer. Due to variation the cost of the projects became higher as compared to the planned one. The same situation is occurred in case of Nekempt-Mekenajo road upgrading project. If the contractor follows the design manual properly the variations will be minimized. As we observe from case of Alamata-Mehoni-Hewane disagreement is occurred due to lack of awareness of the contractor knowing the ERA 2002 design manual.

CHAPTER FIVE

5. Conclusion and Recommendation

5.1 Conclusion

In this final project I have tried to describe in detail design bid build and design build project delivery system and their existing problems during design and implementation. The views of employer's contractor and consultants with regard to the design bid build and design build has been sought. The attitude of their views have similarity with the information in the literature has been cross checked.

Based on these finding on the study the following conclusion is made.

- As it is observed in case study at Nekemte-Mekenajo upgrading road project (contract price is close to 2,380,000birr/km) contractors tend to give lower bid price in DBB since risk is minimal & number of participant are many.
- As it is seen in case study at Nekemte-Mekenajo upgrading road project, projects with design bid build are not subjected to be complete with budgeted cost and time.
- Projects with design bid build are highly subjected for variation works (change order), for this Nekemte-Mekenajo upgrading road project is a good example (35.46% variation)
- Project with design bid build have a nature which cost is unknown until project is complete as it seen in Nekemte-Mekenajo upgrading road project.
- As it is observed in Alamata-Mehoni-Hewane project with design build works are likely for Potentially accelerated schedule because the contractor is onboard at the beginning and because of the overlapping of design and construction work.
- Costs in design build delivery are well defined earlier in the project process as it is seen in Alamata-Mehoni-Hewane project.
- Projects with design build are not subjected for variation works (change order), we can see in Alamata-Mehoni-Hewane upgrading road project is a good example (6.2% variation)

5.2 Recommendation

Specific recommendation for conducting future research in comparison of design bid build and design build delivery system

- This research has been conducted by taking two projects as a case study one with design bid build project and the other with design build. If future researcher include more projects in their study then the conclusion might be differ from this research.
- This research has been conducted only by focusing on federal road projects. Future researches have to be includes building, water works and other infrastructure projects in order to see each delivery systems pros and cons with respect to the nature of the work.
- This research has been conducted by interviewing key professional from client, contractors and consultants as a result there would be a limitation of getting information from middle level project management staff, regulators, municipality land use & administration bureau, Ethiopian electric power corporation and suppliers. So future researches have to be carry out by considering project middle level managers like site engineers, office engineers and construction engineers, regulators, municipality land use & administration bureau, Ethiopian electric power corporation and suppliers.
- This research has been conducted by taking projects that are completed during my research work. So there is no possibility to see occurrence of moment of cost over run and time over run in a project life time. So future researches have to include projects that are not complete during the progress of the work.
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